JAN. 1922 Vol. 4 No. 11

Published at Toronto

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AVIATION & WIRELESS NEWS

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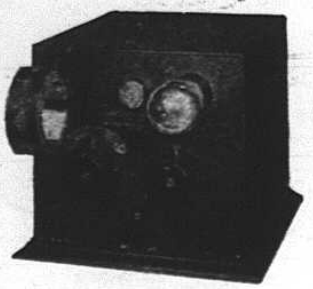

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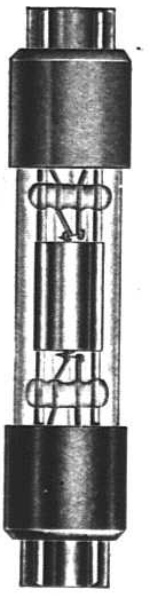
We have a stock of both the RAC audions and receptacles now on hand and can fill orders promptly.



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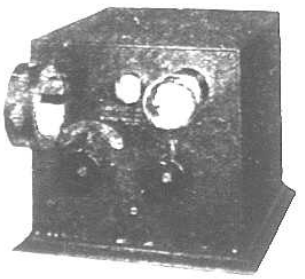

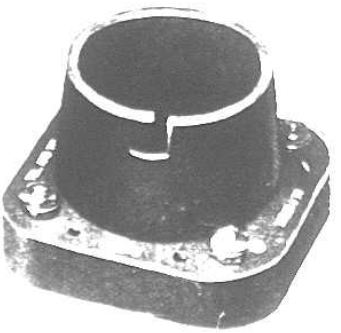

AERO CLUB of CANADA

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The Royal Aero Club of The United Kingdom and The Federation Aeronautique Internationale

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Club Headquarters: 34 Yonge Street, Toronto

OBJECTS OF THE AERO CLUB

1. TO PROMOTE AND MAINTAIN A SOCIAL ORGANIZATION OR CLUB FOR THE ADVANCEMENT AND ENCOURAGEMENT OF VARIOUS FORMS OF AVIATION.
2. TO ADVANCE THE DEVELOPMENT OF THE SCIENCE OF AERONAUTICS AND ITS PRACTICAL APPLICATION.
3. TO ENCOURAGE AND ASSIST THOSE DESIROUS OF TAKING UP AVIATION WITH A VIEW OF RENDERING SERVICE TO KING AND COUNTRY.

OBJECT NO. 1

Club quarters are being maintained, including lounge, billiards, cardroom and lunchroom.

* Until further notice the Clubrooms are open daily from 9 A.M to 10 P.M. except Sundays and public holidays

* Meals are served daily to members and their guests.

* THE DIRECTORS ARE NOW CONSIDERING PROPOSITIONS FOR MORE ADEQUATE QUARTERS IN WHICH IT IS HOPED TO PROVIDE BEDROOM ACCOMMODATION FOR VISITING MEMBERS.

* As soon as deemed advisable and practicable, the Club will endeavour to maintain and operate an airharbor and suitable aircraft for the use of membets, or to make suitable arrangements with an existing concern.

* Out-of-town members are invited to write in to the club on any matters in which the Club can reasonably render personal service for members.

OBJECT NO. 2

Ways and means are being provided for making the Club a clearing house and information bureau on matters of aeronautical interest.

* Members and others are invited to correspond with the Club — especially those who are engaged in commercial aviation, or are in a position to teach flying.

* Owners of aircraft open for contract work are invited to register with the Club. Full information with regard to equipment and terms should be given.

* It is desired to obtain costs of operation in order that reliable data may be compiled for the use of members and aviation interests.

OBJECT NO. 3

The Club is in favour of the Government maintaining an Air Force on adequate and economical lines consistent with the considered opinions, as to organization, of those competent to advise.

* The Club will use its influence and organization in encouraging the youth of our country to engage in aeronautical work for the development of our commerce and natural resources, and for service to the Empire when necessary.

MEMBERSHIP

Membership is open to Officers of the Canadian Air Force, Officers and Cadets of the Royal Air Force, and other branches of the Canadian and Imperial United Services; also to civilians wishing to take up or become interested in aviation generally. Apply to the *Secretary* for terms of membership and appplication forms.

Membership carries privileges of visiting membership in all Aero Clubs throughout the world affiliated with the Federation Aeronautic Internationale.

The regular monthly issue of *Avaition News* is mailed free to all members.

AERONAUTICAL SPORTING EVENTS, RECORDS, ETC.

The Federation Aeronautique Internationale is recognized throughout the world as the dominant authority for the control of aeronautical sporting events and for the establishment of aeronautical records, and provides the necessary rules and regulations for the conduct of such. By agreement through the Royal Aero Club of the United Kingdom, authority has been vested in the Aero Club of Canada to represent and act for the F. A. I. in the Dominion of Canada.

RADIO RESEARCH CLUB OF CANADA

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Professor of Electrical Engineering, University of Toronto.

President

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Radio Engineer—Canadian Independent Telephone Company, Limited.

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8 Strachan Ave., Toronto.

Committee

W. C. C. DUNCAN, E. J. BOWERS, CAPT. J. E. GENET

THE OBJECTS OF THE CLUB

(1) To advance the art and science of radio communication by bringing together those who are interested in radio work, whether as scientists, professional radio engineers, manufacturers of radio apparatus, students, experimenters—in short—all those whose work or interest brings them in touch with the problems of radio.

(2) To conduct and co-operate in radio research.

MEMBERSHIP

Membership is open to engineers, students and anyone else interested in the electrical side of Radio. Application for membership should be sent to the Secretary-Treasurer. They should state experience in Radio work and give as references names of thre members of the Club..

MEETINGS

Meetings are held every third Thursday in Room 23, new Electrical Building, University of Toronto. A programme of papers by prominent Canadian Radio Engineers is being prepared for the coming season.

RADIO INQUIRY DEPARTMENT

As an assistance to those interested in Radio, an Inquiry Department is being conducted in "Aviation and Wireless News," for particulars of which see announcement set out elsewhere in this issue.

A WORD TO YOU CANADIAN RADIOISTS: As a pioneer who has been, and is, associated in executive capacity with some of the largest radio companies and projects, I extend to you "GREETINGS."

Your country offers wonderful and unlimited radio possibilities which you must develop. If any of our apparatus can serve you, I would ask that you order from your regular dealer, who is always glad to provide our products.

JOHN FIRTH, President.

AVIATION & WIRELESS NEWS

A. F. PENTON & Co., Publishers. C. E. WILLIAMS, EDITOR C. LINCOLN-MITCHELL, Publication Manager

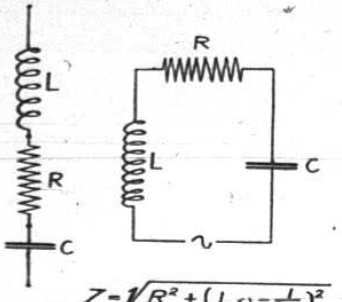
Volume 4. TORONTO, JANUARY, 1922. No. 11

ANTENNA REACTANCES*

By W. C. C. DUNCAN (9AW)

Any conductor, which includes partial conductors, or so-called insulators, has three inherent electrical properties:—resistance, inductance and capacity. The role of the last two is not always fully recognized when dealing with currents at radio frequencies, because usually in direct-current work they are non-important.

The effective resistance, or impedance, Z, of a circuit consisting of a resistance, an inductance and capacitance



$$Z = \sqrt{R^2 + \left(L\omega - \frac{1}{C\omega}\right)^2}$$

Fig. 1

connected in series (see Fig. 1), is given by the following relation (see Fig. 1).

where R is the ordinary ohmic resistance and X is the net reactance due to the inductance and capacitance.

The reactance due to inductance is usually considered as a positive quantity, and as the reactance from a capacity or capacitance has an effect opposite to that from an inductance, it is then considered a negative quantity.

Reactance is also dependent on the frequency of the applied emf, and from the sine-wave theory of alternating currents inductive reactance is X = (L × 2 pi × f) ohms.

where L is the inductance in Henrys, f is the frequency in cycles per second.

The factors (2 pi × f) are usually expressed by the Greek letter "omega," but in this text we will employ the lower case Roman w.

Then X = (L×w) ohms.

Also the capacitive reactance is X = (−1/Cw) ohms.

Where C is the capacitance in farads and w same as before, and since inductive reactance is to be positive, the capacitive reactance is negative.

Then, using the small prefixes l and c before X to denote inductive and capacitive reactance respectively we have the impedence

$$Z = \sqrt{R\,R + (lX + cX)\,(lX + cX)} \text{ ohms}$$

$$= \sqrt{R\,R + (Lw - 1/Cw)\,(Lw - 1/Cw)} \text{ ohms}$$

This is a general formula holding for both direct or alternating current, for with direct current w = O and so Z = infinity.

For with direct current w = O and then Z = infinity or, if there is no capacitance, Z = R.

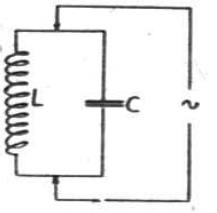
The total reactance will also become zero to an alternating emf

if Lw = 1/Cw

that is Lw — 1/Cw = O

whence again Z = R.

When such values of L, C and f are chosen that this happens the circuit is said to be in resonance, for it is at this particular frequency that the least opposition is given to the flow of current in the circuit. The usual operation of "tuning" in radio work is simply the adjustment for this condition of minimum impedance.



$$X = \frac{1}{C\omega - \frac{1}{L\omega}}$$

Fig. 2.

If, however, the emf is applied in parallel to the inductance and capacity (see Fig. 2), an entirely different value of impedance is found. In this case

$$Z = \frac{1}{\sqrt{(Cw - Lw/R.R + L.L \times w \times w)^2 + (R/R.R + L.L.w.w)^2}}$$

if Cw = Lw / R × R + L × L × w × w

Then Z = R × R + L × L w × w / R

* Abstract of Paper delivered before the Radio Research Club of Canada.

or if R is very small compared to the reactances, as it usually is in radio circuits,

Then $Cw = Lw / R \times R + L \times L \times w \times w$
becomes $Cw = 1/Lw$
and $Z = O + L \times L \times w \times w / O =$ infinity.
or the impedance becomes very great when the resistance is low.

This effect is used in the detector circuit, the detector usually being a potential operated device. An emf is induced in the secondary, and due to the high impedance of the circuit very little current flows, that is very little voltage drop, or the greater part of the induced emf is available to be applied to the detector.

This discussion has assumed the possibility of isolating the resistance, inductance and capacity of the cricuit in definite parts of the circuit. This can be attained to a high degree at low frequencies, but at radio frequencies the capacitance of one turn of an inductance to other turns has an appreciaoble effect, and the inductance of even a few inches of wire is to be reckoned with.

The most pronounced case of this is the radio antenna where both the capacity to earth or counterpoise and the inductance are distributed along its whole length. A graphical representation of the conditions would be as in Fig. 3.

The mathematical analyses of circuits having distributed inductance and capacity are usually based on the assumption that these are uniformly distributed. This condition is very seldom approximated in radio practice, except in the horizontal position of a flat-topped antenna.

In most radio calculations the resistance is usually neglected, as in well designed apparatus it is very small compared with the reactances. For instance, the impedance of an ordinary 50-turn honeycomb coil calculated from the data supplied by the manufacturers has an impedance at the frequency corresponding to 200 metres of 240.00137 ohms a reactance of 240 ohms and a resistance of 1.2 ohms. So, except in a circuit at resonance, information as to its reactance gives its impedance to a possible degree of accuracy much in excess of that required, so from now on only the reactance factor will be discussed.

J. S. Stone has shown that the reactance of the horizontal portion of an antenna, that is the part C D, Fig. 3, has the value

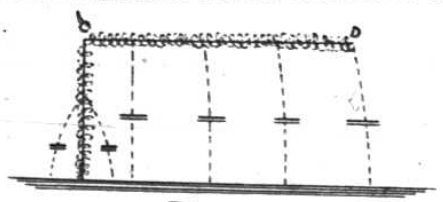


Fig. 3.

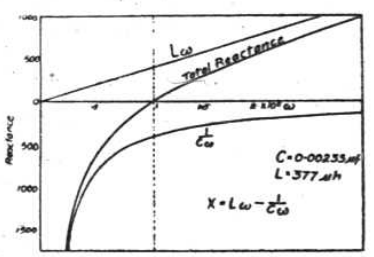
$$X = -\sqrt{Lo \div Co} \cot. w\sqrt{LoCo} \text{ ohms}$$

where Lo is the inductance for uniform current Co is the static capacity.

The value Lo is not the same as the effective radio inductance of the antenna because Lo requires the current at C to be the same as that of D, but it is quite evident that the current at D must be zero. However, Lo can be very easily calculated and Co measured at a low frequency.

On account of the trigonometrical function cot. (cotangent) appearing in the expression, the value of X will change with frequency, starting at infinity negative, passing through zero, and becoming infinitely great, and then repeating the cycle as the frequency is increased from zero. Thus there will be regularly occurring values of negative, positive and zero reactance for increasing frequency.

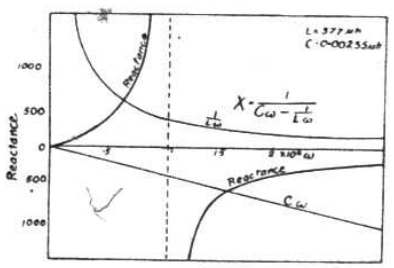
An extremely simple way to see the effect of these various reactance phenomena is to plot them as graphs on a frequency base.



Series Circuit
Fig. 4.

Thus, in Fig. 4 the reactance of the simple series circuit is zero at resonance, in Fig. 5 the reactance of the parallel circuit becomes infinite at resonance, and in Fig. 6 the interesting diagram of the flat top portion of an antenna. On this last graph the corresponding wavelengths are shown at the points of infinite and zero reactance.

The recurring points of zero reactance indicate the possibility of more than one frequency or wavelength



Parallel Circuit
Fig. 5.

being present. This is the explanation of the harmonics with which all those connected with radio are familiar.

If an inductance or loading coil is connected in series with the antenna there will be two reactances present in the circuit, one for each, and the net reactance will be zero when the sum of these two reactances is zero. Thus the resonant frequencies will change as shown each frequency being less than its previous value. That is, the wavelength is increased. Also the harmonic frequencies are no longer simple multiples of the first or fundamental frequencies.

The effect of a condenser also shifts the resonant and harmonic frequencies to corresponding grades of w increasing the frequency or decreasing the wavelength. In Fig. 6,
lX = Lw, the reactance of the inductance and cX = 1 /Cw, that of the condenser.

This theory only properly relates to the horizontal portion of an antenna with uniformly distributed capacity. In the radio section of the School of Engineering Research of the University of Toronto an investigation was made to see the possible error introduced by calcu-

lating Lo from the dimensions of the antenna and measuring Co at a low frequency. The reactance curves were plotted, and then the reactance was measured and the points thus found noted on the graph. One antenna

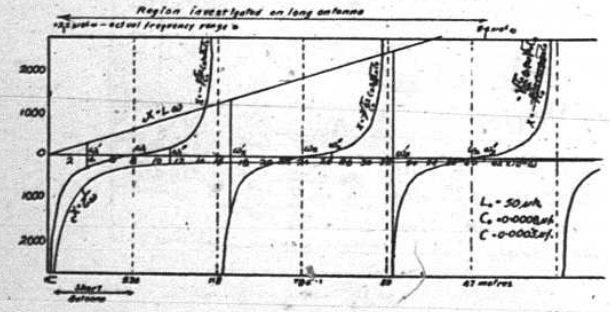


Fig 6.

had a natural wavelength of 1117 metres or 268,580 cycles frequency and a length of 900 feet (single wire). The total length was used in the calculation of Lo as the lead in was very short and practically horizontal. Measurements were made covering a range of wavelengths from 8000 to 190 metres, or if Fig. 6 was to the proper scale, the frequencies represented by the line at the top of the figure.

Another antenna of a natural wavelength of 193 metres was also used.

The results agreed remarkably, and if plotted on diagrams of the size of Fig. 6 the errors could not be seen.

The possibility of utilizing an harmonic wavelength rather than the fundamental for radio transmission opens up interesting possibilities. Prof. Ballard of Cornell University described at the Eighth District Radio Convention in Buffalo how at Cornell an antenna with a natural wavelength of 850 metres had an inductance and capacity added to it so that its fundamental frequency, corresponding to w, was 690 metres and the wavelength corresponding to w2 was 285 metres.

The closed circuit of a spark transmitter was tuned to this wave and coupled to the antenna. The resulting wave was well within the decrement requirements, and no other wave could be detected with a sensitive wavemetre between 100 and 3,000 metres.

Another antenna of the same effective height, but small enough to permit its being tuned in the ordinary way to the 285 metre wavelength, was available. In this antenna the current was 10 amps, while on the first and larger antenna oscillating at w2, the current was only 4 amperes for the same power expended in the set. However, the rather surprising result was obtained that the received signals at a distant station were very much better with the small current on the big antenna oscillating at the harmonic w2.

RADIO CLUB REPORTS

On this section the Editor will be pleased to publish reports of any of the various Radio Clubs. Such reports should be submitted in the exact form in which they are to appear, the Editor, however, reserving the right to edit and curtail the reports if necessary. Papers of special interest read before such Clubs will be also acceptable for publication.

THE RADIO RESEARCH CLUB OF CANADA

For the benefit of those who are contemplating making application for election to membership in the Radio Research Club of Canada we are publishing below an alphabetical list of members of this club in good standing on Jan. 1st, 1922. The names of at least three of these members must be given as references in making application.

J. W. Askham, 567 College St., Toronto, Ont.
E. J. Bowers, 37 Lowther Ave., Toronto, Ont.
H. S. Brown, Lansing, Ont.
G. A. Cline, 379 Huron St., Toronto, Ont.
C. A. Culver, Ph.D., President, Royal Cecil Hotel, Toronto, Ont.
F. K. D'Alton, Secretary-Treasurer, 8 Strachan Ave., Toronto, Ont.
W. A. Dancey, 23 Surrey Place, Toronto, Ont.
W. C. C Duncan, 196 Ellsworth Ave., Toronto, Ont.
G. F. Eaton, 351 Gladstone Ave., Toronto, Ont.
C. R. Fraser, 93 King St. East, Toronto, Ont.
R. A. H. Galbraith, 19 Regal Rd., Toronto, Ont.
J. E. Genet, 163 Collier St., Toronto, Ont.
C. A. Lowry, 219 Robert St., Toronto, Ont.
T. E. Molden, 46 Sorauren Ave., Toronto, Ont.
H. B. McKenzie, 366 Spadina Ave., Toronto, Ont.
H. H. Moor, 63 Tranby Ave., Toronto, Ont.
Prof. T. R. Rosebrugh, Honorary President, 92 Walmer Road, Toronto, Ont.
B. L. Silver, 27 Dundonald St., Toronto, Ont.
R. B. L. Snow, 108 Wells St., Toronto, Ont.
C. E. Williams (Editor Aviation & Wireless News), 60-62 Adelaide St. E., Toronto, Ont.
F. R. Young, 3 Glebe Rd., Toronto, Ont.

MEETING OF W.A.O.O

The general meeting of the Wireless Association of Ontario was held on December 29th, 1921, in Room 23, S. P. S., University of Toronto. About 140 members and friends were present.

The W.A.O.O. had on this occasion the honor of having present at the meeting Lt. Com. C. P. Edwards, who is Director of the Radio Branch, Dept Naval Service of Canada. Lt. Com. Edwards gave a short talk, in which he commented upon the surprising growth in membership and activities since he had last been with us. He also commended to our notice the recent communications from Ottawa regarding proposed radio legislation, and asked the Association to give an official report and recommendation as to the views of local amateurs upon the subject of Federal radio laws.

A receiving contest was staged at this meeting. Several gentlemen brought forth their sets, which were tested for efficiency by popular judgment. The sets were consecutively connected to the S. P. S. aerial and radio 3CY broadcasted music, on which all sets were tested. First prize in this contest was won by Mr. Harvey Galbraith; second prize went to W. F. Choat, and 3rd prizes to Messrs. Young and Duncan, who tied for third place.

Wireless Association of Ontario

(Organized in October, 1913)

PROF. T. R. ROSBRUGH, Toronto, Hon. President

OFFICERS

W. C. C. DUNCAN, Past President.
C. A. LOWRY, President.
KEITH RUSSELL, Vice-President.
W. F. CHOAT, Secretary-Treasurer,
241 Robert St., Toronto.

COMMITTEE

H. H. MOOR, E. J. BOWERS, R. YOUNG,
F. A. CLARK, T. C. CHURCHILL.

The members of the club did the judging by hand vote, and the signals from the respective sets were turned into a 3-step amplifier and rendered audible to the assembly through a Brown loud speaker. The executive expressed themselves as dissatisfied with the result of the judging, as it was thought that Messrs. O'Brien and Pole procured the best signals of the evening, although they received no awards.

The W.A.O.O. wishes to express its gratitude to the following dealers for valuable assistance afforded to this contest:

To the Marconi W/T Co. of Canada for a $10.00 cash prize which was given as first award.

To Messrs. T. Eaton Co. for one ITCO amplifying transformer, awarded as second prize.

To Messrs. The Vimy Supply Co. for the loan of a Brown loud speaker and an H. T. battery.

The address of the New York station, or 2XB, is: Western Electric Co., 462 West Street, New York, United States, also the new Westinghouse Station at Newark is coming in QSA, their call is WJZ.

The Wireless Association of Ontario extends to Mr. E. Rogers (3BP) their hearty congratulations for being one of the eighteen amateurs to bridge the Atlantic on nights of Dec. 7-17 last.

WIRELESS LAWS AND THE W.A.O.O.

The first meeting of the 1922 season was held by the W.A.O.O. in Room 25, S.P.S., U. of T., on Jan. 19th. All Ontario amateurs were invited to be present and enter into the discussion of the proposed new radio laws. About 150 Ontario amateurs were in attendance, and a very lively discussion was held.

The following list of Recommendations was drawn up and sent to the Department of the Naval Service for its approval:

1. Wavelengths:
   (a) That the use of "Plain Aerial" spark transmitters be absolutely prohibited.
   (b) That a wavelength of 200 metres be allowed for spark transmitters, and 250 metres for C. W. transmitters; and that the power input to any transformer or triode be limited to 500 watts.
2. Operator's Certificates:
   (a) That no operator's certificate be required for "receiving only."
   (b) That all operators using transmitters of any kind be required to satisfy the inspector by written examinations, as to—
      1. Knowledge of traffic regulations;
      2. Ability to receive and transmit a minimum of 15 words per minute.
   (c) No person shall operate a transmitter unless he has possessed himself of the required operator's certificate.
3. Self Heterodyne:
   That no action be demanded at the present time regarding self-heterodyne interference.
4. Call Signs:
   That the intermediate signs now in use between American and Canadian amateurs as adopted by the A.R.R.L., be recognized and approved by both American and Canadian Governments.
5. Interference:
   That no licensed amateur shall operate a transmitter between the hours of 8.30 p.m. and 11 p.m. on week nights, or between the hours of 7.30 p.m. and 10 p.m. on Sunday nights, unless he can satisfy the inspector that such transmission does not interfere with reception by any other licensed amateur of any commercial radiophone broadcasting that is being carried on during those stated periods.
6. That the Department take immediate steps to have a permanent Radio Inspector for Ontario with headquarters at Toronto, or, alternatively, a part-time inspector permanently resident in the City of Toronto.
7. That the Department give utmost publicity through the press to radio laws and requirements.

CANDIDATES SUCCESSFUL IN RADIO EXAMINATIONS

The Radio Department of the Naval Service announces that thirty-nine (39) candidates were examined during the month of December, 1921, of which the following were successful and obtained Certificates of Proficiency in Radiotelegraphy:

1st Class (Commercial)

Name.	Address
Aveling, A.,	Cape Race, Nfld.
Best, E. G.,	Truro, N.S.
Bombardier, J. L. E.,	Montreal, P.Q.
Durie, R. V.,	Benito, Man.
Carman, H. G.,	Vancouver, B.C.
MacDougald, D. S.,	Shediac, N. B.
Miller, H. J.,	Cape Race, Nfld.
Millette, J. P. P.,	Montreal, P. Q.
Sutherland, W. M.,	Trenton, N. S.

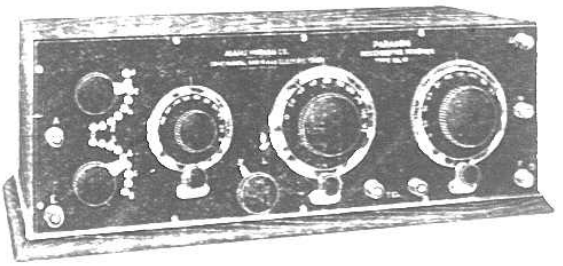
Amateur

Adams, C. M., Winnipeg, Man.
Allardyce, V. P., Vancouver, B. C.
Bell, G. D., Winnipeg, Man.
Buchanan, W. C., Winnipeg, Man.
Clements, J. A., Vancouver, B. C.
Collins, J. B., Vancouver, B. C.
Good, N. A., New Westminster, B. C.
Goodmanson, T., Winnipeg, Man.
Longley, C. E., Vancouver, B. C.
Mason, E. P., Vancouver, B. C.
Macpherson, W. G., Vancouver, B. C.
Michelmore, H. R. L., Vancouver, B. C.
Nicholson, E. L., Winnipeg, Man.
North, F. J., Winnipeg, Man.
Pugh, A. G., Winnipeg, Man.
Rutland, F. E., Winnipeg, Man.
Speechly, W. G., Winnipeg, Man.
Stevenson, F., Winnipeg, Man.
Thomas, W. T., St. Vital, Man.
Trotter, C., Vancouver, B. C.
Tufts, S. St. C., Vancouver, B. C.
Mowatt, H. B., Vancouver, B. C.

WESTINGHOUSE BROADCASTS

Under date of January 1st, 1922, the Westinghouse Electric & Manufacturing Company published the first number of their weekly folder, entitled "Radio Broadcasting News." This is called the KDKA Edition, and contains full particulars regarding programme for the following week.

PARAGON
RA-TEN
Price - $100



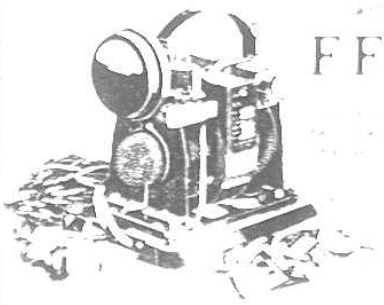
GREBE
CR-5
Price - $110

MONTREAL

The Barwick Radio Co.

High Grade Radio Apparatus

10c Charges Your Battery



FF BATTERY
BOOSTER

STORAGE BATTERIES

Vacuum Tube Without Storage Battery is Practical Device for Radio Reception

A vacuum tube that does not require a storage battery, bnut which will give comparable results for radio reception, is described for the first time as being a practical device that can be utilized with a new regeneration receiving set.

Harry M. Ryder, of the Research Laboratory, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in the Electric Journal says that "a new tube has recently been developed which makes the use of a storage battery unnecessary. Fig. 1 shows the tube

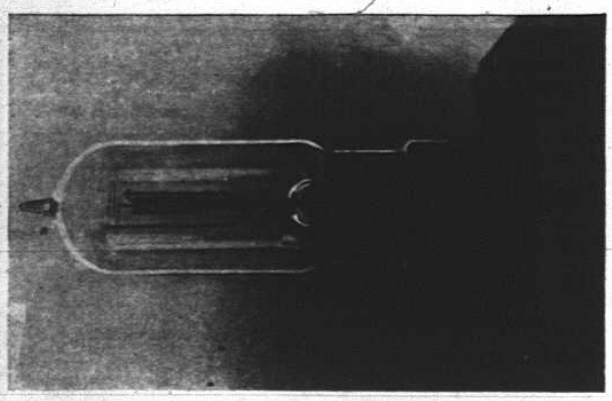


Fig. 1—New Vacuum Tube Requiring Less Than 0.25 Watt for Heating Filament.

reproduced to two-thirds actual size. It is somewhat smaller than most tubes and fitted with a base designed to prevent its being accidentally placed in a stock supplied by a six-volt battery and thereby having its filament ruined. This base is also designed to prevent the accidental connecting of the plate potential to the filament terminals.

"The filament requires but 1.1 volt to operate and uses 0.2 ampere continuously. This means a power consumption of less than one-fourth watt as compared with 3 to 5 watts in the ordinary tube filament. For this reason it is possible to operate the filament from a single dry cell and avoid the greater expense and trouble incident to the use of a storage battery. In addition to this advantage, a plate battery of 22 volts is sufficient for all work, except where the utmost in signal strength is required, in which case a plate potential of 30 volts will give slightly better results. A higher potential than this is never necessary and a potential above 22 volts is seldom needed, hence this tube makes unnecessary the use of a second B battery block, and the expense incident to it. Again, the tube is hard, so that the plate voltage adjustment is not critical, no adjustment being necessary on that account.

"An idea of how long a dry battery should last in the service required by this tube is given in Fig. 2 and 3. In both cases it has been assumed that the tube is to be operated one hour out of each twenty-four. Fig. 4 is added to show how the power obtained from a single No. 6 dry cell will vary with the rate at which the dry cell is drawn upon. Thus, if several dry cells in series were used to supply a filament requiring 0.8 ampere, only five ampere-hours would be available from each cell before its voltage would have dropped to one volt at the end of

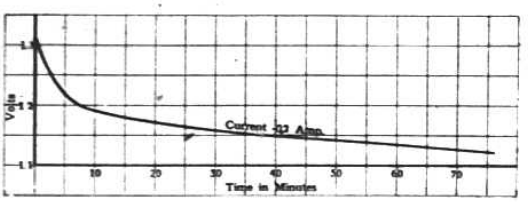


Fig. 3—Drop in Voltage During Run of a No. 4 Dry Cell Which is Nearly Exhausted.

a one-hour run, while 22 ampere-hours would be available for supplying a filament requiring 0.2 amperes before the voltage would take a corresponding drop.

"This information illustrates the wonderful possibilities of this tube in a portable receiving outfit. It is probable that more such outfits were carried to camp during the summer of 1921 than during any previous season, in spite of the limitations imposed by a storage battery. This "dry cell" tube now makes it practicable for a party on an extended canoe trip into the wilds of Canada to carry

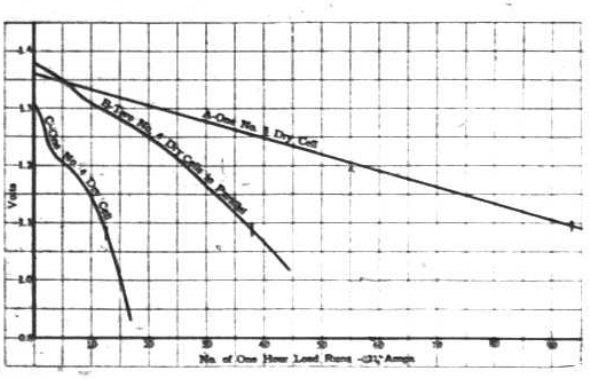


Fig. 2—Voltages of Dry Cells at the Ends of Successive One-Hour Run.

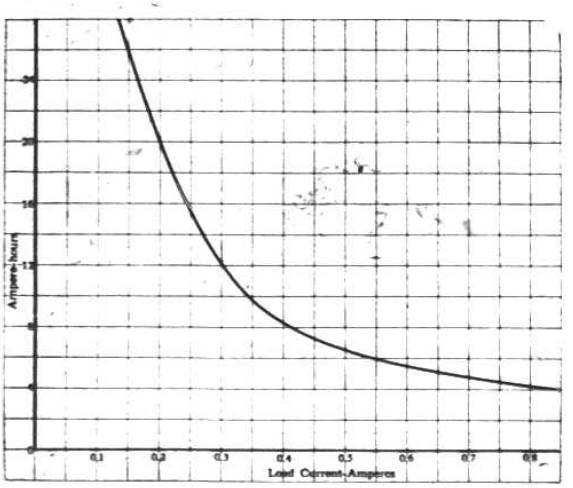
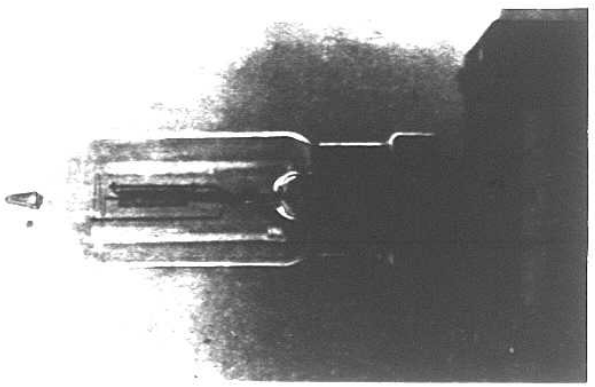


Fig. 4—Power Available From a No. 6 Dry Cell When Operated for One Hour a Day, with a Final Voltage of 1.1 Volts.

Vacuum Tube Without Storage Battery is Practical Device for Radio Reception



with them a receiving set of small dimensions and weight, and of sufficient range to keep in touch with world affairs. With the present radiophone broadcasting of market and stock reports, and the Post Office Department's proposed extensions of this method of announcement, it is not necessary that a man become an expert at copying code in order to take advantage of such opportunities.

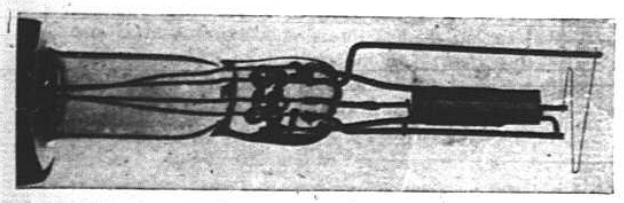


Fig. 5—Assembled Electrodes of the New Vacuum Tube.

"The advantage is not limited, however, to the portable set. In the home, a dry cell is always to be desired in preference to a storage battery, not only on the score of economy, but also because a dry cell may be located in any convenient place.

"It is logical to ask how this great decrease in filament power consumption has been accomplished. The design of every essential element in the tube contributes to this end. Fig. 5 shows the interior arrangement, and Fig. 6 the elements which go to make up this structure. The filament is of platinum, about one-eighth as thick as fine tissue paper, and one one-hundredth of an inch wide. This is coated with a very thin layer of certain oxides, with the result that a special form of Wehnelt cathode is formed. This filament is welded to end supports for easy assembly, and is kept in position by the aid of a specially constructed and very flexible form of spring. This spring enables the filament to move freely in case of a severe jar, but otherwise to be held firmly in place. It results in an exceedingly rugged structure for so delicate a strip. The grid and plate are of the common forms except that very small and exact dimensions must be used. If accuracy and inspection were not carefully maintained, inoperative tubes would result. The assembly is centred about the electric welding machine, and this operation has been

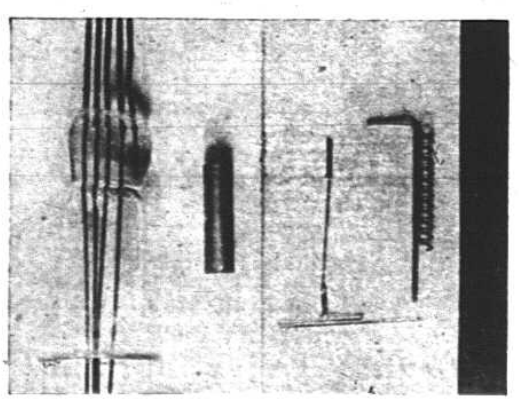


Fig. 6—Parts of the New Vacuum Tube.

refined to a very high degree to make possible such products as are represented in this tube. The final operation in obtaining this tube is performed by the exhaust system. Here special apparatus and special schedules have been developed to make possible a tube of high quality and uniformity.

"A characteristic curve for this tube, Fig. 7, shows that the usual filament and plate structure and dimensions have in no way produced undesirable variations in this curve. The amplification factor is approximately seven, and a plate impedance of about 22,000 ohms is obtained, making it possible to insert this tube in any of the usual circuits designed for a low impedance tube, without fear of unsatisfactory operation.

"In operation, the low voltage and power requirements of this tube make certain precautions necessary to the uninitiated user. The filament operates at a low red heat instead of at the bright point to which users of tungsten filament tubes are accustomed. If a six-volt battery were to supply power to this filament with only the usual six ohm rheostat in series, the filament would have a very short life, since the rheostat would not have sufficient resistance to cut down the current to the proper value. At a bright yellow heat this filament will deteriorate rapidly, even though the inexperienced eye may consider it to be operating at a conservative temperature It is necessary, therefore, until the operator is well acquainted with this tube, that he take special precautions to maintain the filament current at the lowest value which will give full sig-

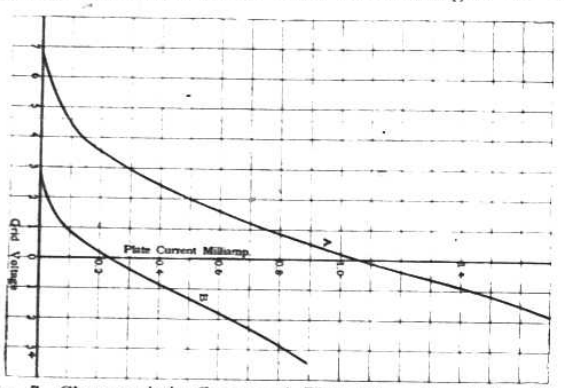


Fig. 7—Characteristic Curves of Plate Currents at Two Plate Voltages.

nal strength. The filament will give no warning, such as a bright light, or noise in the phones, when it is being operated beyond its proper temperature, so that the responsibility for a long filament life lies with the operator in making the proper rheostat adjustments, unless a ballast lamp is used. If this simple rule is followed, the user of this tube will find that he has a new device which will not only make good radio operation more economical, but will enable him to enjoy it with much less attention to the accessories, and in places where he had not thought it possible to carry a set."

AMRAD BROADCASTING STATION IXE

The American Radio and Research Corporation, familiarly known as Amrad, is well known to radio amateurs for its broadcast station IXE at Medford Hillside, Mass. This station has a range of 1,000 miles, and is at present operating on 310 meters. They are frequently heard in the Toronto district, Montreal and Nova Scotia

Their present regular schedule is given below. In addition they have feature programmes given by prominent musical artists and speakers.

Regular Schedule: Every evening 8.00—Police Reports for City of Boston. Sunday evening, 8.15—Radio Sermon. Monday evening, 8.15—Babson Business Reports. Tuesday evening, 8.15—Bedtime Stories for the Children. Wednesday evening, 8.15 Popular Musical Programme. Thursday evening, 8.15—Bedtime Stories for the Children. Friday evening, 8.15—Amateur Night, Code Practice. Saturday evening, 8.15—General news.

CORRESPONDENCE FROM READERS

CANADIAN AMATEURS APPRECIATE "AVIATION AND WIRELESS NEWS"

Since the addition of Wireless to the field covered by our magazine, the publishers have received many letters of appreciation from Canadian radio enthusiasts. The want for a Canadian radio publication was real, as is shown by the support being received. The following is only one of many such letters being received:

92 James St., Ottawa, Dec. 27, 1921.

Aviation & Wireless News:

Dear Sirs,—Having seen the November copy of your magazine I now enclose my subscription for the same. I trust it will start with the December copy.

I feel that Canadian radio amateurs' want for a radio magazine has been filled by Aviation & Wireless News.

Yours very sincerely,
ALAN G. SIMMONS.

Windsor, Nova Scotia, Nov. 17, 1921.

Editor, Aviation & Wireless News, Toronto:

Dear Sir,—I have just reecived a sample copy of your magazine, and am much pleased with same.

I am glad to know that at last Canada has a *real* radio magazine. Might I suggest that a few more constructional articles would be appreciated. I would like very much to see descriptions of the apparatus mentioned in the report of the W.A.O.O. on page 12 of your October issue.

Enclosed you will find a money order for $1.50, for which kindly send to my address Aviation & Wireless News for one year, commencing with the November issue.

Very truly yours,
C. H. STAN.

MODULATION PHENOMENA IN RADIOTELEPHONY

The apparatus now used for transmission in radiotelephony uses three-electrode electron tubes as an essential part of the equipment, with the exception of a few high-power stations which use high-frequency alternators. The development of small and comparatively inexpensive radiotelephone transmitting equipment has been made possible only by the rapid development of the electron tube. The use of radiotelephony is now being rapidly extended, and it is being used for the broadcasting of news of different kinds, such as weather and market reports.

In radiotelephony a wave of a radio frequency such as a million cycles per second is varied in amplitude or "modulated" at audible frequencies such as 1,000 cycles per second, in accordance with the wave form of the sound which is being transmitted. The device by which this modulating process is accomplished must respond instantaneously to the variations of the impressed sound wave, and must therefore have negligible inertia, in order that sound may be transmitted without distortion. The electron tube is a device which answers these requirements, since the electron stream will respond instantaneously to variations in the audio-frequency wave. The phenomena occurring in circuits for modulating radio-frequency currents may become very complex, and require careful study. Three principal methods of modulation in electron tube radiotelephone transmitting sets are recognized: First, by variable absorption of the output power of a generator of radio-frequency current, as by inserting a microphone in the antenna circuit; second, by varying at speech frequencies the opearting grid voltage of a tube generating radio-frequency current; third, by varying at speech frequencies the input plate voltage of a tube generating radio-frequency current. The third method is often referred to as "plate modulation," and is the method used in commercial and military types of apparatus in the United States. Plate modulation is superior to the other methods in many respects.

Studies have been made at the Bureau of Standards, Washington, of the phenomena of modulated radio-frequency waves, and the relative advantages of different methods of modulation and different circuits. The apparatus used in radiotelephone transmitting sets employing plate modulation has been analyzed as consisting of four units—the source of direct current, the modulator unit, the generator unit, and the radiator unit. Oscillographic studies have been made. Results of these studies are contained in a publication of the Bureau of Standards just issued, Scientific Paper No. 423, Operation of the Modulator Tube in Radiotelephone Sets, by E. S. Purington. Copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, D.C., for 10 cents. Persons desiring information regarding radiotelephony will find this paper of considerable interest.

"MACK" STARTING AND LIGHTING BATTERY IN RADIO SERVICE

The following are a few facts regarding the service obtained from a Type "M" "Mack" Automobile Storage Battery in use in private radio work for heating the filaments of transmitting and receiving vacuum tubes:

Length of service—Approximately one year.

Severity of service—Approximately 50 amp. hours per month (fairly persistent working for an average amateur station).

This battery would operate these valves quite satisfactorily for about 2½ months, *i.e.*, until discharged to such an extent that the float of a commercial automobile hydrometer would sink and would not come to the surface until charging had been in progress for about 5 hours at 7 amps. In each instance, however, the specific gravity would rise in reasonable time to a value of 1.3 and the same period of service would elapse before charging was again necessary.

Water was added to the electrolyte only at the time of charging, as evaporation of the same was very slow.

For short periods during the year the battery served as an auxiliary in a motor car, where the net discharge helped to drain it, and invariably it came out of the car with a lower gravity than when installed.

This battery is still in use and apparently not in the least deteriorated.

Radio Manufacturers and Dealers Section

THE F-F BATTERY BOOSTER IN RADIO

F-F Battery Boosters, which are magnetic rectifiers of alternating current, and were originally developed for use in charging automobile and lighting batteries, are found highly satisfactory for charging radio storage batteries.

There is nothing more exasperating than to have one's station closed because of a discharged battery, or to have your friends call to "listen in" and then find the battery dead.

A rapid full charge is essential to put the battery in condition again, and for this service the F-F Magnetic Rectifier has been found to have a decided advantage

over either the bulb or metal contact type of rectifier, as the former is feeble in action and subject to renewal at any time without warning, while the latter will short-circuit the battery through the metal points sticking.

Unless a good rate of current is used, especially at the start, the battery plates will become charged in spots, so to speak, because of insufficient current to act over the whole surface at once. This is very unsatisfactory, and any coating of sulphate on the plates resulting from undercharging will not be removed, meaning that sooner or later the battery will require a heavy charge to break down the sulphated condition and bring it back as near as possible to its first satisfactory condition.

The F-F Rectifier is of the full wave type, which means a maximum current delivered. Carbon rectifying brushes maintain uninterrupted service at constant efficiency. Since carbon is infusible, there is no chance for the Rectifier to burn out or stop functioning, and a high charging rate is delivered at the beginning of a charge with safety. A strong permanent magnet causes the battery circuit to operate if line current fails, and makes it impossible for the Rectifier to put current through the battery in the wrong direction. All Boosters are equipped with an ammeter, which leaves nothing to guess work. You know positively if current is flowing into battery and at what rate.

When the gravity of a battery is low the plates are in a condition to take a heavy current, which greatly shortens the over-all time to complete a charge. Near the finish of a charge the battery gasses with a rise in voltage. This counteracts the fixed voltage of the rectifier and automatically reduces the charging current to a finishing rate, which is the ideal method.

A full charge is completed in the shortest possible time, which is found by the latest experiments to be best for the battery. Think what it means to be able to put your battery back in service within several hours instead of having to wait indefinitely with an unsatisfactory charge at best. These features are highly prized by users of F-F Boosters, manufactured by The France Mfg. Company, Cleveland, O. Canadian representatives, The Battery Service and Sales Company, Hamilton, Ont., Canada.

Specially drawn for AVIATION & WIRELESS NEWS by Herb. A. Sherlock

CHANGE IN POSITION OF RADIOTELEGRAPH STATION

The radiotelegraph coast station at Montreal, call sign VCA, has been removed from Tarte pier to a more favorable site at Sault au Recollet. Particulars of the change in position are as follows:

Old position—Latitude, N. 45 degrees, 32 minutes, 45 seconds; longitude, W. 73 degrees, 31 minutes, 45 seconds.

New position—Latitude, N. 45 degrees, 34 minutes, 05 seconds; longitude, W. 73 degrees, 38 minutes, 05 seconds.

Other particulars of the station remain unchanged.

Canadian Authorities Taking Steps to Prevent Alleged Interference

The following letter has been recently sent out by the Radio branch of the Department of the Naval Service of Canada:

Sir,—I have the honor to advise that the Department, following the procedure adopted during the past two winters, has authorized the use of 200 meters wavelength for transmission by amateur stations on the Great Lakes and River St. Lawrence during the coming winter. This order will be effective from the 15th December, 1921, to the 1st May, 1922.

I would also inform you that the Department proposes, in the near future, to take under consideration the desirabilty of changes and amendments to the regulations regarding amateur experimental stations, with a view to meeting recent developments in radio practice, it being the wish of the Department to accord to amateurs every reasonable facility compatible with the proper protection of the "Commercial," "Aid to Navigation," and the other more important services.

We should be glad to have an expression of views of your association in this reference, particularly with regard to the following points:

Wave Lengths

(1) In the event of a maximum wave length of 200 metres being authorized for amateur stations, would it be in the general interest of amateurs to reserve this wave length exclusively for c.w. stations and to establish some shorter wave length, say, 150 metres, for spark stations?

As far as the commercial stations are concerned, experience shows that a C. W. station accurately adjusted for 200 metres, will not interfere with a commercial station using 300 metres, unless such stations are very close together. A 200 metre spark station on the other hand, even if carefully adjusted, is liable to interfere with a 300 metre station at a much greater distance.

Under the present regulations interference with commercial services is practically nil, but as the wavelengths are increased control will become more and more necessary, and the Department will have to rely on associations and individual licensees to assist in exercising the same, otherwise commercial services will be interfered with and the Department will be compelled to revert to the original restrictions.

Certificates

(2) In the event of the Department deciding that it cannot authorize the establishment of increased wavelengths for amateur experimental stations unless the operating standard now demanded of the licensee is also raised, would it be a hardship to demand in such cases an operating speed of 10 or 12 words per minute? This proposal would contemplate the establishment of two or more classes of wavelengths and the licensee would not be permitted to use a higher wavelength until he had demonstrated his ability to operate at the prescribed speed.

Self-hetrodyne

(3) The attention of the Department has been called to the considerable interference which exists between amateur experimental stations themselves due to transmission from the oscillating receiving valves. This can, to a certain extent, be overcome by the use of a separate hetrodyne at receiving stations, and the question arises as to whether or not it would be in the interest of amateurs to restrict in any way the use of the self-hetrodyne.

Call Signs

(4) Are the call signals at present allotted to amateur experimental stations in Canada proving satisfactory? The Department is prepared to give consideration to reasonable suggestions with a view to avoiding duplication with call signs issued to stations in the United States, if it is shown that such duplication is a drawback.

Interference

(5) Are any broad regulations of a general character necessary or desirable for the regulation of the working of amateur stations, with a view to avoiding interference one with the other?

Some control of the working amateur stations would appear to be desirable. This would be effected either by local arrangement between licensees themselves or by Departmental regulation. The latter procedure has the disadvantage that regulations which might be desirable in Toronto or Montreal, would be quite unnecessary in, say, Sault Ste. Marie.

The numerous complaints filed with the Department regarding what can only be considered as selfish interference on the part of several licensees, indicate that some regulation will be neecssary sooner or later to protect the interests of the licensees operating reeciving stations only. For instance, a regulation along the following lines, has been asked for:—

"No licensed amateur located within the limits of the city of ———— shall transmit whilst the radio-telephone concert of the ———— Company is being given from —— p.m. to —— p.m. Tuesdays and Saturdays, until he shall have demonstrated to the satisfaction of the Departmental Inspector that the operation of such transmitter will cause no interference wtih the reception of the concert at any of the licensed stations."

General

Should your association accede to our request to express its views on the above points, I should be glad if you would arrange to submit them to the Department before the 31st January, 1922, when they will receive our careful consideration.

If, before formally submitting your resolution, there are some questions you would like to refer to the Department, I should be glad if you would communicate directly with the Director of Radio Branch, of this Department, who will be pleased to advise you.

I have the honor to be, Sir,

Your obedient Servant,

(G. J. Desbarats)

DEPUTY MINISTER.

RADIO INQUIRY DEPARTMENT

Conducted under the direction of The Radio Research Club of Canada.

This department will be edited by the Secretary of the above club and the questions will be answered by the member considered to be most familiar with the particular field in question. Where the question is considered of sufficient importance it will form the basis for a discussion at a regular meeting of the club.

Answers will be given covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here, other queries being answered by mail.

The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions from one reader can be answered in the same issue. The club does not obligate itself to answer here any question entailing considerable research work, intricate calculations, patent research, etc. However, such an inquiry will be acknowledged and the writer advised as to the basis upon which the question can be answered.

WESTINGHOUSE TO COVER COUNTRY WITH RADIO BROADCASTING SERVICE

On account of the great success and wide-spread interest that has been the outcome of pioneering in radio-telephone broadcasting by the Westinghouse Electric & Mannfacturing Company, the company has announced a complete plan of covering the entire United States with a service to the home that will allow anyone, anywhere in the country, to enjoy the many benefits of radio. The operation of the first radio broadcasting station of its kind in the country at East Pittsburgh, Pennsylvania, for the past twelve months, has opened possibilities hitherto undreamed. From this station alone persons in Canada, New England, Florida, Arizona, the Dakotas, and at greater distances, have been able to enjoy the service. Even in Cuba, Mexico, and on ships in the middle Atlantic and on the Gulf of Mexico many have heard the concerts broadcasted from East Pittsburgh.

In order to cover certain parts of the country not reached by this station, and to intensively service other parts, the Westinghouse Company has laid out a complete programme, and has already added three large stations. At Springfield, Mass., station WBZ supplies New England; at Newark, N.J., station WJZ takes care of the Middle Atlantic and Southern States; and at Chicago, Ill., station KYW services the Middle and Western States.

The fact that the pioneer work of Westinghouse has not been in vain is shown by the fact that although operating a full year, station KDKA at East Pittsburgh continues to interest more people as time progresses. This is due, however, not so much to the novelty of radio telephone broadcasting, but to the well-planned and diversified programme that has been established. The service started with the transmission of presidential election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theatres, musical recitals, reports of boxing contests, results of baseball, football and basket ball games, complete minstrel shows, Government market reports, New York Stock Market reviews, national and international news from the station at East Pittsburgh. At Springfield, Mass., in addition to many of these features, there is a periodical talk to farmers about market and stock conditions. A feature of the Newark, N.J., broadcasting station has been bedtime stories for the children, marine information, and talks on radio. The complete transmission of grand opera from the Chicago Opera Company productions has been the feature of the recently established station on the Commonwealth-Edison Building in Chicago. It is predicted that as a result of the diversified entertainment and information which have been broadcasted through these stations during the past year this service will prove of expanding value and distinctive interest to mankind. In all probability radio will be as popular in the home as the phonograph is to-day and will be of as great interest to the public as the moving picture show.

The programmes as conducted by Westinghouse usually last for an hour each evening, and they are announced far enough in advance to enable everyone interested to know what is contemplated. Such stars as Geraldine Farrar, Rachmaninoff, Telmanyi, Clarence Whitehill, Mary Garden, Muratore, Edith Mason, and Rasia have performed for the radio, and the programmes are put on a very high plane. Many speakers of note have talked over the radio, some of them being Secretary of Commerce Herbert Hoover, Assistant Secretary of the Navy Theodore Roosevelt, Secretary of War Weeks and Secretary of Labor Davis.

In order to perfect the transmission of music by radio has been built especially for the singing of artists, so that the reproduction will be accurate. The studio at East Pittsburgh consists of a room 20 ft. by 30 ft., completely lined with burlap and cloth and without windows, so that there will be no reflection of sound. The attached chart is used to determine the proper position of the microphone, and a report is made for each musical selection. These reports are checked later with the reception qualities at a receiving outfit. A considerable amount of data already obtained indicates the proper methods of transmitting various types of music.

This work is simply a sample of the many things being done to perfect the service and make radio broadcasting a real benefit to the public.

AMRAD RADIOPHONE SCHEDULE FOR WEEK ENDING JAN. 28, 1922

Every Night—Police Reports for City of Boston at 8 p.m. (The broadcasts below follow directly after the Police Reports). Monday—"The Federal Reserve System as Related to American Business," from an address by W. P. G. Harding, Governor of the Federal Reserve Board; Babson Business Report; Liberty Bond Quotations. Tuesday—Health Talk No. 3, "Sleep," by B. A. Welcome, Executive Secretary, Junior Dept., American Red Cross; Bedtime Story for the Little Folks, "Stevie's Partridge," by Eunice Randall; "Music from Mars." Wednesday—Popular Musical Programme. Thursday—Bedtime Story for the Little Folks, "Adopting a Grandmother," by Eunice Randall. Friday—Amateur night; Code Instruction; New licenses announced. Saturday—General news; Health Talk by U. S. Public Health Service. "Canned" music every evening. Coming—Concert by the combined musical clubs of Tufts College.

AERO CLUB OF CANADA ANNUAL BALL

The Aero Club of Canada, which has done much as a national organization to keep the Canadian flying officers together and continue this country's interest in aeronautics, gave its first annual ball in December, and it proved to be a great success and a credit to the efforts of those who arranged for it. A great number of well known people were present. The following official report is interesting·

The Aero Club of Canada, H.R.H. the Prince of Wales, hon. president; patronesses, Lady Byng, Mrs. Cockshutt, Mrs. C. A. Maguare, Mrs Thomas Gibson, Lady Eaton, Mrs. A. E. Gooderham, Mrs. S. Casey Wood and Mrs. James Vance, held its annual dance at Jenkins' Art Gallery, Toronto. Three hundred guasts were present. In one of the little alcoves, Col and Mrs. Gibson, Mrs. A. E. Cooderham, Mrs. Casey Wood and Mrs. Vance received. Mrs. Gibson was in a black chiffon velvet gown, with bead trimmings; Mrs. A. E. Gooderham, in a smart trained gown of cloth of silver, with grey tulle. She wore ropes of pearls, diamond tiara, and carried a feather fan. Mrs. Casey Wood was smart in apricot taffeta, with gold lace, and mauve flower at the girdle; pearl necklace. Mrs. Vance was in black velvet and lace. Both rooms were used by the dancers, and the excellent orchestra was stationed behind a screen of palms. The officers of the Aero Club wore their smart uniforms, and were delightful hosts. At supper time little tables were brought into the ballroom. The programmes were most attractive, being in the club's colors. Among those present were: Mayor-elect Maguire, General John Gunn, General C. H. Mitchell; Mrs. John Gunn, in a smart black charmeuse, embroidered and cut in flounces. She wore a pearl necklace. Mrs. Arthur Murray, smart frock of cloth of gold and net draperies, girdle of gold cords; Col. A. E. Gooderham; Mrs. Stuart Wilson, delf blue chiffon brocade, with silver lace, rose at the side, draperies, pearl necklaces; Col. and Mrs. Barker, the latter in a smart black charmeuse, with overdress of net, diamond bar pin, rope of pearls; Miss Victoria Gooderham, in cloth of gold, with blue brocade panels; Miss Armstrong, pale mauve taffeta, with gold leaves in her hair; Miss Laura Jenkins, French grey chiffon velvet lace, corsage of sweetheart roses, pearl necklace; Miss McKay, shot green taffeta, roses at the corsage; Miss Shefle, in black shiffon velvet, blue roses; Mrs. B. L. Anderson, powder blue satin with gold brocade, pearl necklace, diamond comb; Mrs. J. F. M. Stewart, gold-colored charmeuse, with brocade and bangles; Major and Mrs. Bradley, the latter very smart in black sequin and net, Richmond rose on the bodice, gold bandeau in her hair; Mrs. Nelson Tate, in black velvet with ropes of sequins, girdle of rose-colored beads; Mr. and Mrs. Charles Mitchie, the latter in a smart frock of petunia net with purple girdle; Mrs. MacSherry, smart frock of American beauty draped chiffon velvet with tulle, corsage of violets, silver shoes; Miss Howe, Sunset charmeuse, with bugle trimmings, tulle scarf, black feather at the waist; Mrs. Leith Spence, in pale green, silver brocade, with green draperies, green feather fan; Miss Ryerson, black satin with gold and silver lace; Mr. and Mrs. Troughton, the latfer in a peacock blue gown, with pearl necklace; Miss A. Bavington, in coral georgette with blue girdle, silver flowers; Miss Cholwill, black net and jet; Miss Hodgens, coral tulle with silver, coral feather fan; Miss Jean Robinson, flesh-colored brocade with lace, pearl necklace; Miss Audrey Horricks, in a pretty frock of Niaid green shot taffeta, corsage of roses; Mr. and Mrs. W. H. Martin, the latter in maize georgette with black flower at her girdle; Mrs. R. L. Fairbairn, in brown radium lace and charmeuse, amber beads; Mrs. Willows, black chiffon velvet with black tulle, corsage of orchids and sweet peas, pearl necklace, tortoise-shell comb; Miss Mary Price, black sequin gown with girdle of cerise, diamond bar pin; Miss Constance Wilson, rose silk and georgette; Mr. and Miss Newcombe, Mrs. Arthur Newcombe, Mr. and Mrs. C. A. Ellis, Mr. and Mrs. J. M. Stewart, Mr. and Mrs. Alfred Fisher, Dr. and Mrs. Tate, Mrs. Ely was gowned in white charmeuse with white Chinese cape shawl with deep fringe; Miss Bonnie Bonnell, pretty in peach-colored chiffon velvet, pearl necklace; Mrs. Norman Stanley, smart gold and net over cloth of silver, pearl necklace, tulle bandeau; Miss Helen Woodland, sequin and net frock, touches of Victory blue; Miss H. Weir, black net and sequins, roses at the back of the girdle, green coq feathers in her hair; Miss Dimple Snow, cerise chiffon velvet; Miss Rhoda Snow, pretty in a pale orchid georgette with bugles, pearl necklace; Mr. and Mrs. McKinnon, the latter in black net and sequins, lace scarf, velvet flowers at the girdle; Dr. and Mrs. Gordon Armstrong, Miss Ruth Ayer, G. P. Alexander, Miss M. R. Allen, Miss E. Aubin, Capt. S. P. Armstrong, Mr. A. J. Burbidge and Mrs. Burbidge, Mrs. Brown, Miss Bray, Mr. and Mrs. E. S. Bolsby, W. G. M. Brown, Miss M. Barrington, R. C. Burrows, Miss H. Borker, L. A. Budd, Miss R. Blizzard, E. H. Bullen, J. W. Butters, Major and Mrs. M. E. Bradley, Miss M. W. Bonnell, Miss M. Bell, Miss M. Bath, Col. and Mrs. Barker, Miss N. Bungay, Mr. and Mrs. Chas. Bulley, Keith Bruce, Dr. and Mrs. A. M. Bell, G. R. Coulthardt, Dr. and Mrs. Lorne Cook, A. Campbell, Miss Ann Cherry, W. M. Cameron, S. Cyril, Miss Chiswell, J. M. Catto, H. Cameron, Mr. and Mrs. F. A. Clarke, Mr. and Mrs. Connon, Miss Mildred Caise, Mr. and Mrs. F. H. Duncan, Mrs. Duncan, Mr. and Mrs. R. J. Dilworth, Miss Ellis, Mrs. Elliott, Miss B. Ellis, Mr. and Mrs. C. Ellis, L. S. Forsyth, Mrs. I. Fould, Mr. and Mrs. R. L. Fairburn, Mr. and Mrs. Russell Fitch, C. E. Frend, Mr. Robert Forsyth, Miss R. E. Findlay, Mr. and Mrs. A. B. Fisher, L. Flaws, Mr. and Mrs. G. Finch, Miss Lilian Gray, Miss L. Grant, Mr. and Mrs. C. B. Gibson, Mr. and Mrs. Gourlay, T. Hopkins, F. Hotrum, Miss E. Henderson, Mr. and Mrs. H Hudson. R. M. Hillman. Miss Dorothy Hodgins, Mr and Mrs. N. H. Herbert, Mr. and Mrs Lonsdale Hammill, Miss C. Hamilton, D. G. Hagarty, Mr. and Mrs. Lloyd Harris, Mrs. G. E. Hallam, Miss Hallam, W. R. Hallam, Miss M. Howe, Col. and Mrs. D. G. Joy, V. F. Johnston, E. J. Jacques, F. M. Jeffrey, Major Kempthorne and Mrs. Kempthorne, F. D. Kilts, A. B. Kenny, Mr. and Mrs. H. B. King, H. M. Keith, Miss Ann Kelly, Mr. and Mrs. T. Kinnear, J. Kilbourne, Mr. and Mrs. Percy Kane, Dr. Lee, Norman Leishman, D. G. Lawrence, G. E. Lillico, Miss Dorothy Leach, Miss Gertrude Lindner, Mr. and Mrs. R. W. Leonard, F. S. Lush, F. D. Leonard, Mr. and Mrs. E. F. Leonard, Miss Leonard, N. J. Laughlin, Mr. and Mrs. Laing, Mr. and Mrs. C. E. Langley, Capt. Lloyd Lott, Mr. and Mrs. F. C. Mitchell, A. F. MacDonald, Miss M. Millman, Miss M. E. McGuire, Capt. H. O. McDonald, Mr. and Mrs. P. S. McLean, W. N. McDonald, Miss Vera McLean, Mr. and Mrs. G. A. Mayor, W. E. Mayor, Miss L. Mayor, Miss Doris McKay, Mr. and Mrs. R. Miller, Mr. and Mrs. John S. McKinnon, Mr. and Mrs. A. B. Mendert, Mr.

and Mrs. M. C. McCordie, Miss P. MacNeil, J. J. Martin, Miss Lilian McArthur, Dr. and Mrs. A. L. McKay, W. A. McLeod, Mr. and Mrs. W. MacFarlane, Mr. and Mrs. H. H. Miller, Mr. and Mrs. W. H. Martin, Miss Aileen Nicholl, Miss Nixon, Miss Ray Northwood, Miss K. Newcombe, Miss B. Oxley, Miss H. Orr, Mr. G. O. Parry, Mr. W. B. Powell, Miss M. Powell, Miss M. Price, Miss M. Pearce, Mr. and Mrs. Playman, Miss Marion Pearcy, Mr. and Mrs. A. F. Penton, Mr. and Mrs. M. C. Purvis, Dr. and Mrs. J. R. Pirie, Miss E. Rodgerson, J. R. Robinson, Miss Margaret Russell, Mr. and Mrs. H. C. Rochester, Miss Edith Reedy, Mr. and Mrs. A. R. Rennie, Mr. and Mrs. Percy Robertson, Dr. and Mrs. Risdon, Mr. and Mrs. T. A. Russell, Col. and Mrs. Bart Rogers, Miss Doris Rough, Miss G. Secord, A. H. Sheed, Miss R. Stewart, Reford Stewart, Miss L. Simpson, Mr. and Mrs. J. M. Shook, Miss Scott, Mr. and Mrs. W. F. Sparling, Mr. Somerville, Mr. W. A. Sonter, Miss Esther Strachan, Mr. and Mrs. G. M. Smith, G. M. Shaw, Miss J. Sinclair, Miss H. Schiffler, Miss E. M. Sheppard, R. S. C. Stalker, H. M. Smeeton, Mr. and Mrs. F. J. Stewart, Dr. and Mrs. G. J. Steele, Mr. and Mrs. C. M. Sparling, Mr. Stupart, Mr. and Mrs. L. Spence, Mr. and Mrs. Roy Troughton, Dr. and Mrs. Fred Tisdall, Mr. and Mrs. F. L. Tait, W. M. Thompson. W. J. Thompson, Mr. Cameron Urquhart, J. D. Vance, Miss R. Vance, Mr. and Mrs. C. G. Vanstone, Miss N. Verner, Miss G. Winger, O. H. Willison, Mr. and Mrs. George Way, H. N. Westwood, Mrs. Wickson, G. West, Miss J. Worthy, Miss C. Wilson, O. H. Williams, Miss H. Whorton, M. A. Wilson, Miss C. Wedd, H. S. C. Wilson, Mr. and Mrs. S. C. Wood, Mrs. E. M. Wood, Miss Helen Woodland.

AERIAL FOREST PROTECTION IN MANITOBA

District Fire-ranger A. M. Maclead reports that after personally viewing the aerial system of patrol work, he is convinced that the system will work splendidly, and that the Lake Winnipeg district of that section will now get the protection its timber supply warrants. In support of his favorable conclusion he speaks of a fire spotted forty miles at 4 p.m. one day, being fought by fire fighters transported to the fire by flying boat at 6 a.m. the following day, and tells of other fires being extinguished because men were on the job to handle them at the right time. Thus investors in valuable timber lands in Manitoba may feel safe while there is an efficient aerial patrol maintained to safeguard their interests.

"BRISTOL" GAS STARTER FOR AERO ENGINES

The "Bristol" Gas Starter has been designed to provide an extremely simple, effective and sure means of starting aero engines of six or more cylinders up to 500 h.p. No matter how cold or obstinate an engine is, the use of this starter obviates the necessity of touching the propeller.

The starter may be operated from inside the fuselage and during flight. It may be installed in any convenient position at any distance from the engine.

HELIUM IN TEXAS

The helium plant at Fort Worth, Texas, has been placed on a production basis, and progress is being made in the development of the helium. A non-rigid airship of the C class is being inflated with helium at the naval air station, Hampton Roads, and a practical demonstration of the use of this gas will shortly be made. This will be the first airship that has ever operated with an inert gas.

AERIAL PHOTOGRAPHY

Two projects of a large nature during the year have been undertaken, namely, the construction of a photographic map of the Mississippi Delta, for the Coast and Geodetic Survey, and the photographic mapping of the naval reservation at Guantanamo Bay for the Hydrographic Office. Experimental work in connection with the rapid development of photographs, the actual development of photographs in planes, accurate and a standardized system of photographic mapping, have been undertaken with success.

The use of aerial photography in determining the results of gunfire has been undertaken and found of great assistance to the office of gunnery exercises in determining accurately the results of gunfire in target practices.

HIGH HIVER, ALBERTA

No aircraft patrols were delayed or cancelled except for weather conditions, is the excellent report from High River Air Station. For the month of July, twenty-six patrols were completed out of a possible thirty-one, counting Sundays. A fire was located at Beaver Creek, and so quickly were the rangers on the spot, that less than one acre was covered by the fire. The location given by the aerial route observers was "about section six, township ten, range twenty-nine, west of the fourth meridian." It was actually just across the line, in section five, so that the location given was very good indeed.

U. S. NAVAL RADIO

Arrangements have been made permitting naval radio stations to transmit to neighboring naval air stations direct and to the Weather Bureau the weather reports received from ships at sea. Arrangements have also been made at Coco Solo to have ships entering and leaving the Canal Zone send back weather reports while within radio communication. Steps have been taken to arrange for a world meteorological broadcasting system by radio, but to date these have not been acted upon by the international communication conference.

U. S. AIR STATIONS

A minimum number of air stations necessary for the proper training of personnel and operation of aircraft with the fleets has been maintained throughout the year. The following stations have been in operation: San Diego, Calif.; Hampton Roads, Va.; Anacostia, D.C.; Pensacola, Fla.; Lakehurst, N. J.; Rockaway, Long Island. Outside the continental United States: Coco Solo, Canal Zone; Pearl Harbor, Hawaii. Stations under the Marine Corps: Quantico, Va.; Parris Island, S. C.; Port au Prince, Haiti; Santo Domingo, Dominican Republic; and Guam.

THE NEW MORANE-SAULNIER MONOPLANE

We learn from "Flight" that M. Saulnier, the well-known French designer, has just completed the designs for a large cantilever monoplane which is to have seating accommodation for 16 passengers, and will be driven by three Lorraine-Dietrich engines, of which two will be placed in the leading edge of the wings, after the fashion of certain German planes, and the third in the nose of the fuselage. The monoplane wing will have a span of 88 feet 6 inches, and the wing area will be 1,250 square feet. The weight empty has been estimated at 9,450 pounds, and the weight "all on" at 15,400 pounds. It is estimated that the machine will take off with two engines, and fly at 1,500 feet on one engine.

SUMMARY OF AVIATION IN UNITED STATES

Naval aviation activities in the U. S. during the fiscal year ending June 30, 1921, continued to be scattered throughout various offices of the different bureaus of the U. S. Navy Department. With the lack of a co-ordinating central office to handle aeronautical matters, conditions were especially trying in the endeavor to promote naval aviation. This condition continued until September 1, 1921, when the Bureau of Aeronautics was established in the Navy Department. Notwithstanding the trying conditions that have existed during the past year, progress has been made both in the development of types of planes and in general aeronautical research work. Some of the outstanding features of the year's work cover the following:

(a) Flights of the Atlantic and Pacific Fleet air forces to the Panama Canal and their return.

(b) The flight of F-5-L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia.

(c) Marine Corps flight from Washington, D.C., to Santo Domingo City and return.

(d) Bombing experiments conducted on the ex-battleships Indiana and Iowa, and on ex-German warships.

(e) Practical completion of the large rigid airship shed at Lakehurst, N.J., and advancement in the construction of the rigid airship ZR-1 at the naval aircraft factory.

(f) The completion of a competition for the design of planes suitable for use from battleships.

(g) The continued progress in fitting the U. S. S. Langley as an aircraft carrier.

(h) The practical completion of the U. S. S. Wright as a lighter and heavier than air tender for aircraft with the fleets.

(i) Mileage flown by naval and marine aircraft for fiscal year, 2,511,055 miles.

The value of naval aircraft to the fleets has been demonstrated in spotting gunfire, in scouting, and in bombing.

Last year radio communication between aircraft and surface vessels was very elementary. Development has been made during the past year, so that it is now possible for an airplane to be in direct radio communication with land stations and surface craft for considerable distances and under adverse weather conditions.

HEAVIER-THAN-AIR

The accomplishments of the fleet air forces have been particularly gratifying. Nine F-5-L flying boats of the Atlantic Fleet air force made the trip from Philadelphia to the Canal Zone and return. Twelve F-5-L flying boats of the Pacific Fleet air force flew from San Diego to the Canal Zone and return. The actual distance covered in the flights of these two detachments approximate 12,000 miles.

Other flights of note during the past year were those of two DH-4B airplanes by the Marine Corps, from Washington, D.C., to Santo Domingo City and return, and the flight of F-5-L flying boats from Colo Solo, Canal Zone, to Cartagena, Colombia. The marine flight covered a distance of approximately 5,400 miles and the flight from Coco Solo a distance of about 800 miles.

In addition to the torpedo instruction that has been given at Pensacola, Fla., and the traning flights and firing of dummy torpedoes at San Diego, the Atlantic Fleet torpedo division has operated from Yorktown, Va., as a base, and has conducted expreimental research work in firing actual, as well as dummy, torpedoes.

The air forces of each fleet are now composed of scouting, spotting, combat, torpedo and bombing, and kite balloon squadrons.

As a result of competition among the aircraft manufacturers of the United States a type of plane suitable for spotting work is being developed, the award having been made to the winner of this competition, the Dayton Wright Co., and they are now engaged in producing the first planes of this type. To date none have been delivered.

It was arranged by the Army and by the Navy to loan to contractors planes which had been built by them for the Pulitzer race for the purpose of entering them in the contractor's name and at his risk and expense. The race this year was won by a Navy plane loaned to a contractor in this manner fitted with a 400-horsepower engine, and showed a higher speed than the 600-horsepower plane which won the last year's race. This indicates very satisfactory progress in aeronautical design in the past year. The reliability of the planes taking part in the race was better than the year before, but still leaves room for improvement.

The question of developing a means for launching planes from battleships while under way or at anchor, which would do away with the objections to the platforms now installed on the guns, has been undertaken, and further development of the catapult, as originally

suggested by Capt. W. I. Chambers, United States Navy, is in progress, and appears to offer a solution to many of the difficulties encountred with the turret platforms.

The past year witnessed the successful completion of the new catapult design for launching airplanes or seaplanes from ships of the fleet. This catapult was a development of the catapult that was installed on the North Carolina class of vessel before the war, but has been refined and simplified and reduced to a small track rotating on a turn-table base. Successful flights have been made with this catapult, using standard service seaplanes.

The significance of the catapult development lies in the fact that it is now possible to provide ships of the fleet with fighting airplanes as an answer to the menace of bombing aircraft. The best defence from aerial bombs is considered to be the small fighting airplane, which can be shot into the air at a moment's notice from a ship's catapult and sent aloft to shoot down the attacking bombers, which will be necessarily slow and cumbersome weight carriers, and, as such, extremely vulnerable to attack by planes of the combat type.

PARACHUTES RESCUE FLIER DROPPED IN CRATER LAKE

Wireless and aeronautic science were recently employed in a very timely combination which saved the life of an air-service cadet, flying from Mather Feld, Calif., over Crater National Forest in Oregon. While in the neighborhood of Crater Lake, the spark plugs ceased working in the engine of his plane, and landing was necessary. Choice in landing places was confined to either the rugged mountain peaks below or a small island of black lava in the middle of the lake. After some deliberation he chose the latter, and made a landing in the huge cliff-rimmed cup. The plucky pilot then set his radio outfit in operation, and after many hours of waiting, rescue planes arrived, carrying the necessary spark plugs. Adverse air curents within the great "moon hole" prohibited the descent of the rescuers, and so the plugs were attached to parachutes and dropped. After application of the new plugs, the pilot started his own engine and made a perilous take-off over the lake surface. Circling and dodging about in the twisting air pockets, the plane finally made its way westward over the crater side.

AIRPLANE USED AS AMBULANCE

Little Nellie Cochrane, 11 years old, was pronounced by a doctor to be an immediate subject for operation for appendicitis. There was no hospital or surgeon nearer than five hours away by train, and her physician insisted immediate action was needed to save her. An uncle, Lt. Robert Cochrane, former army aviator, carried her in his plane to Omaha, making the trip in a little more than two hours.

The operation that folowed immediately saved her life, the surgeon said.

4,340 MILE NON-STOP FLIGHT POSSIBLE

Aviation has now been developed to a point where an airplane, theoretically at least, can fly for 6,950 kilometers (4,340 miles) without stopping.

This is the conclusion which has been persented to the French Academy of Sciences by Monsieur Raraud, one of the best qualified French scientists on the subject.

MAY FIGHT FIRES FROM AIR

Fire fighting by airplane is being studied by the Paris fire department. The aviators would be provided with huge bombs, which would explode on striking the burning buildings, filling the atmosphere with a gas that would completely choke the flames, while being absolutely harmless to people.